HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

DRAFT

Hatchery Program	Kalama River Wild Summer Steelhead
Species or Hatchery Stock	Kalama Summer Steelhead *(Oncorhynchus mykiss)*
Agency/Operator	Washington Department of Fish and Wildlife
Watershed and Region	Kalama Subbasin/Lower Columbia Province
Date Submitted	nya
Date Last Updated	August 16, 2004

Section 1: General Program Description

1.1 Name of hatchery or program.

Kalama River Wild Summer Steelhead

1.2 Species and population (or stock) under propagation, and ESA status.

Steelhead (Oncorhynchus mykiss)

ESA Status: Threatened

1.3 Responsible organization and individuals.

Name (and title):	Aaron Roberts
	Lower Columbia Hatcheries Complex Manager
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Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program.

Co-operators	Role
National Marine Fisheries Service	Administrator of Mitchell Act Funds

The steelhead program is funded through the Mitchell Act via National Marine Fisheries Service (NMFS) for the purpose of mitigation for lost fish production due to development within the Columbia River Basin. The program is authorized under the Columbia River Fisheries Development Program, Columbia River Fish Management Plan and U.S. vs. Oregon and the parties to this program, plan and court case are, therefore, involved in short and long-term production planning.

1.4 Funding source, staffing level, and annual hatchery program operational costs.

Funding Sources
Mitchell Act

Operational Information	Number
Full time equivalent staff	6.0
Annual operating cost (dollars)	$605,527

The above information for full-time equivalent staff and annual operating cost applies cumulatively to Kalama River Anadromous Fish Programs and cannot be broken out specifically by program.

1.5 Location(s) of hatchery and associated facilities.

Broodstock source	Wild Kalama River Winter Steelhead
Broodstock collection location (stream, RKm, subbasin)	Kalama Falls Trapping Facility/Kalama River/RKm 16.1/Kalama Subbasin
Adult holding location (stream, RKm, subbasin)	Kalama Falls Hatchery//Kalama River/RKm 16.1/Kalama Subbasin
Spawning location (stream, RKm, subbasin)	Kalama Falls Hatchery/Kalama River/RKm 16.1/Kalama Subbasin
Incubation location (facility name, stream, RKm, subbasin)	Fallert Creek Hatchery/Kalama River/RKm 8.2/Kalama Subbasin
Rearing location (facility name, stream, RKm, subbasin)	Fallert Creek Hatchery/Kalama River/RKm 8.2/Kalama Subbasin; and Kalama Falls Hatchery/Kalama River/RKm 16.1/Kalama Subbasin
Acclimation and release location (facility name, stream, RKm, subbasin)	Gobar Pond/Gobar Creek/4.8 RKm Kalama Subbasin

1.6 Type of program.

Integrated Recovery Program. This would function to re-establish wild natural spawning populations in the Kalama system through research, supplementation and acclimation of summer steelhead.

1.7 Purpose (Goal) of program.

The goal of the Kalama Wild Summer Steelhead Program is to evaluate the use of wild steelhead as broodstock in hatchery programs. This program could be a template to recover wild steelhead stocks in the Kalama River and other regional areas and to assist in a regional effort to recover ESA listed Lower Columbia ESU steelhead. Wild broodstock investigations will identify and empirically quantify risks with natural salmonids and to identify strategies to manage those risks. This will done by 1) assessing natural reproductive success of hatchery steelhead from wild broodstock relative to that of wild fish, 2) assessing the degree of inbreeding between wild fish and hatchery fish from wild broodstock and its affect on productivity of the natural spawning population and 3) assess the efficacy of wild broodstock hatchery programs in achieving natural production and other fishery management objectives including containment of risks to wild stocks.

1.8 Justification for the program.

The use of wild broodstock in hatchery programs has received considerable attention by WDFW (e.g., Wild Salmonid Policy, Steelhead Management Plan and Lower Columbia Steelhead Conservation Initiative) and other agencies responsible for fish management including Northwest Fisheries Science Center of the National Marine Fisheries Service (NOAA), Oregon Department of Fish and Wildlife (ODFW), Idaho Department of Fish and Game (IDFG) and British Columbia Department of Ecology (BCDE). Given the substantial investment in supplementation programs for steelhead harvest and to protect the genetic diversity of wild stocks, this program will contribute to the development of supplementation and harvest augmentation strategies using wild broodstock to the degree natural reproductive success wild stock is changed by hatchery propagation using wild broodstock, the nature and degree of interbreeding between wild and wild broodstock hatchery fish, and the efficacy of wild broodstock hatchery programs in achieving natural production and other fishery management objectives including containment of risks to wild stocks.

The objectives of this work are to: 1) design and implement a wild broodstock hatchery program, 2) assess the reproductive success of hatchery fish from wild broodstock relative to that of wild fish, 3) measure interbreeding between wild fish and hatchery fish from wild broodstock and its effect on productivity of the naturally spawning population, and 4) assess the efficacy of wild broodstock hatchery programs in achieving natural production and other fishery management objectives including containment of risks to wild stocks. A thorough treatment of goals and objectives of the program as well as justification for and benefits of the work in the Kalama Basin is provided in Sharpe et al. (2000).

1.9 List of program "Performance Standards".

See HGMP Section 1.10 See HGMP Section 1.10 The following Performance Standards were adapted from the Artificial Production Review (NPPC, 1999) and modified to satisfy the needs of this program. These performance standards and indicators are designed to provide general guidelines and will be applied to this program as appropriate.

1. Conservation of genetics and life history

Indicator 1.1: Fish collected for brood stock are taken throughout the return or spawning period in proportions approximating the timing and age distribution of the population from which brood stock is taken.

Indicator 1.2: Life history characteristics of the natural population do not change as a result of this program.

Indicator 1.3: Patterns of genetic variation within and among natural populations do not change significantly as a result of the program.

Indicator 1.4: Collection of brood stock does not adversely impact the genetic diversity of naturally spawning populations.

Indicator 1.5: The artificial propagation program is monitored and evaluated on an appropriate schedule and scale to evaluate beneficial and adverse effects on natural populations

2.

Indicator 2.3: Program addresses ESA responsibilities.

3. Achieve hatchery performance standards

Indicator 3.1: The artificial production program uses standard scientific procedures to evaluate various aspects of artificial propagation.

Indicator 3.2: Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols such as those described by IHOT, PNFHPC, the Co-Managers of Washington Fish Health Policy, INAD, and MDFWP.

Indicator 3.3: Water withdrawals for artificial production facility operations will not prevent access to natural spawning areas, affect spawning behavior of natural populations, or impact juvenile rearing environment.

Indicator 3.4: Effluent from artificial production facilities will not detrimentally affect natural populations.

4. Restore and create viable naturally spawning populations

Indicator 4.1: Program contributes to an increasing number of spawning fish returning to natural spawning areas.

Indicator 4.2: Juveniles will be released from acclimation sites to maximize homing ability to preferred return locations.

Indicator 4.3: Juveniles are released at fully smolted stage.

5. Plan program in coordination with mainstem passage and habitat research in the Columbia Basin
Indicator 5.1: Program releases are sufficiently marked to allow statistically significant evaluations of program contribution to natural production, and to evaluate effects of the program on the local population
6. Improve performance indicators to better measure performance standards
7. Do not exceed carrying capacity of fluvial, lacustrine, estuarine and ocean habitats
Indicator 7.1: Annual release numbers do not exceed estimated basin-wide and local habitat capacity, including spawning, freshwater rearing, migration corridor, and estuarine and near-shore rearing.
8. Evaluate habitat use and potential detrimental ecological interactions
Indicator 8.1: Brood stock collection does not significantly reduce potential juvenile production in natural rearing areas.
Indicator 8.2: Adult brood stock collection does not significantly alter spatial and temporal distribution of any naturally produced population.
Indicator 8.3: Depredation by artificially produced fish on naturally produced fish does not significantly reduce numbers of natural fish.
9. Avoid disease transfer from hatchery to wild fish and vice versa
Indicator 9.1:
Releases do not introduce pathogens not already existing in the local populations, and do not significantly increase the levels of existing pathogens. Additionally, the duration of interaction with wild fish can be limited by timing hatchery liberations by rapid out-migration of released hatchery smolts (WDFW 2001). This strategy, along with adherence to fish disease control and minimization policies set forth for WDFW hatcheries, will significantly decrease the likelihood for transfer of disease from hatchery raised salmonids to wild salmonids.
10. Assess survival of captive broodstock progeny vs. wild cohorts
11. Do not deplete existing population spawning in the wild through broodstock collection
Indicator 11.1: Hatchery-origin adults in natural spawning areas do not exceed appropriate proportion of the total natural spawning population.
Indicator 11.2: Adult brood stock collection does not significantly alter spatial and temporal distribution of any naturally produced population.
Indicator 11.3: Weir/trap operations do not result in significant stress, injury, or mortality in natural populations.

1.10 List of program "Performance Indicators", designated by "benefits" and "risks".

Benefits (See performance standards 1-6 in Section 1.9 above):
The benefits identified for the proposed hatchery include increased abundance leading to lower risk of extinction or enhanced recovery, increased nutrient supply from additional spawners, and research that will benefit the conservation of natural populations to offset mortalities caused by dams (WDFW 2001).
Risks (See performance standards 7-11 in Section 1.9 above):
The risks associated with the proposed actions include loss of within and among population genetic diversity, lower productivity due to hatchery effects, hatchery fish masking health of natural populations, and ecological interactions of hatchery and natural fishes.

1.11.1 Proposed annual broodstock collection level (maximum number of adult fish).

60 adults (25 males and 35 females). This maximum collection scenario only occurs in the event that some of the females are in partially spawned condition. In which case, some of the very small egg contributions from partially spent females are pooled to form a "female equivalent" egg lot that would be treated in the mating scheme as if it were the eggs from a single female. Thus, the

sex ratio would not end up being 1:1. Using fully gravid females, the maximum would be 50 adults, 25 of each sex.

1.11.2 Proposed annual fish release levels (maximum number) by life stage and location.

Up to 60,000 smolts at 5.0/fpp are released.

1.12 Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

Wild % of Escap.	Kalama Stock % of Escap.	Brood Year	Wild Escap.	Wild Harvest	Wild Brood Taken	Total Wild Return	Skaman. Hatch. Escap.	Kalama Stock H. Escap.	Hatch. Harvest	Hatch. Trap Count	Total Hatch. Return	Planted 2 yrs previous (Summer)	Smolt to Adult (%)
45%	45%	1990	745	74	0	805	924	0	3609		4533	58201	7.8
41%	41%	1991	704	16	0	721	1034	0	2586		3619	59595	6.1
40%	40%	1992	1075	5	0	1080	1588	0	2612		4201	85960	4.9
32%	32%	1993	2283	204	0	2488	4905	0	4433		9338	68019	13.7
27%	27%	1994	1041	72	0	1113	2797	0	2775		5572	89171	6.2
43%	43%	1995	1302	9	0	1311	1741	0	1573		3314	92525	3.6
35%	35%	1996	614	15	0	629	1150	0	501		1651	100892	1.6
Preliminary Escapement Estimates for Brood Years Below													
20%	20%	1997	598	38	0	636	2395	0	1012		3407	75930	4.5
27%	27%	1998	205	2	0	207	555	0	946	709	2210	80130	2.8
54%	54%	1999	220	26	48	294	187	0	363	735	1285	77941	1.6
82%	82%	2000	140	71	39	250	30	0	1147	1232	2409	66300	3.6
85%	85%	2001	286	38	49	373	52	0	2340	862	3254	89400	3.6
71%	73%	2002	454	41	58	553	184	44	1472	1151	2807		
		2003	805	91	60	956	47	805	5235	4430	10470	100518	5.2
50%	97%	**2003b**	**817**	**116****	70	**1003**	47	817					
54%	66%	**2004**	**632**	**90**	58	**780**	607	531					

Data provided by Pat Hulett (WDFW).

1.13 Date program started (years in operation), or is expected to start.

This research program started in 1998 and involves both Kalama River facilities. The first year of fish culture operations for Kalama Falls hatchery was 1958 while Kalama No. 2 (Fallert Creek) has been in operation since 1895.

1.14 Expected duration of program.

The research project as detailed in Sharpe et al. (2000) will continue through 2011. The relatively intense monitoring of rearing, migration, and residualism will end with the out-migration of the 2001 brood in the spring and early summer of 2002. The balance of the research program will involve monitoring of smolt to adult returns and natural reproductive performance in subsequent years. In 2003, the barrier created by Kalama Falls was damaged and has compromised the study.

1.15 Watersheds targeted by program.

Kalama Subbasin/Lower Columbia Province

1.16 Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

1.16.1 Brief Overview of Key Issues

WDFW is currently involved in a research project on the Kalama River that will provide information on the feasibility of using the native population. This alternative would require utilizing the local stock, which could not occur without better knowledge of the condition of the wild stock   This is a limited research program to evaluate the feasibility of rearing wild steelhead in the hatchery. This program could be a template to recover wild steelhead stocks in the Kalama River and other regional areas. The current facilities were not designed to rear wild steelhead and are not adequate for this program.

1.16.2 Potential Alternatives to the Current Program

Alternative 1: Discontinue the program. WDFW believes that this research may hold the key to steelhead stock recovery in systems throughout the Columbia Basin.

Alternative 2: Clip no fins. Releases should be unmarked to prevent harvest until the wild run is recovered. This alternative is not considered acceptable; the research is be conducted to evaluate the success of producing fish for harvest and natural escapement.

1.16.3 Potential Reforms and Investments

Reform/Investment 1: If the local stock were to be used for this program, investments into the rearing and holding systems will need to happen. The rearing system would require smaller rearing vessels as well as some heated water to accelerate growth to make one year smolts from stock across the entire run time The cost to perform such a modification is currently estimated to be in the range of $100,000 - $200,000
Reform/Investment 2: Adult sorting and handling in general is very hard on adult fish and routinely causes mortality that can be prevented with a modern sorting and handling system designed to cause the least harm possible to all fish handled. A semi-automated sorting system would be comprised of the following: An initial holding pond would collect and hold the fish until sorting is initiated by opening a gaiter, which allows adults to be attracted through a false weir and onto a fabricated, sloped, sorting chute. The chute contains paddles and side chutes. The side chutes lead to different adult ponds, and also provide returns to the river above and below the in stream barrier. An observer located in a control tower above the main chute identifies the fish as it enters the chute and then activities in of the paddles to direct the fish to the desired location. Staff does not physically handle the fish during this sorting process. Adults desired for spawning are directed into the adult ponds equipped with mechanical crowders and a spawning shed at the soppy end. There the adults can be held, crowded, sorted and spawned. Most adult ponds have a river return option as part of the sorting and piping associated with the ponds. The cost to perform such a modification is currently estimated to be in the range of $1,000,000 to $2,000,000.

Reform/Investment 3: Monitoring and evaluation will be needed to insure that the survival of the native population is not impacted and to decrease the risk of impacting other ESA listed species. Additional tributary trapping facilities would be needed to collect genetic tissue samples from adults. Costs for monitoring and evaluation are currently estimated to be in the range of $300,000 to $400,000.

Section 2: Program Effects on ESA-Listed Salmonid Populations

2.1 List all ESA permits or authorizations in hand for the hatchery program.

WDFW is writing HGMP's to cover all stock/programs produced at Kalama Complex including; Columbia River Chum, fall Chinook, coho, summer and winter run steelhead. No ESA permits or authorizations exist for the locally adapted broodstock program identified in this HGMP. This HGMP will be submitted to the National Marine Fisheries Service for ESA review and approval.

2.2.1 Descriptions, status and projected take actions and levels for ESA-listed natural populations in the target area.

Identify the ESA-listed population(s) that will be directly affected by the program.
Lower Columbia River Steelhead *(Oncorhychus mykis*s), were listed as threatened under the ESA on March 19, 1998. In Washington, the LCR steelhead ESU includes winter and summer steelhead in tributaries to the Columbia River between the Cowlitz River and Wind River. The program will directly affect the Lower Columbia River Steelhead ESU because the program involves steelhead incubation, rearing, and acclimation throughout the basin.

- Identify the ESA-listed population(s) that may be incidentally affected by the program.

Lower Columbia River chinook salmon *(Oncorhynchus tshawytsch*a) are federally listed as "threatened" under the ESA on March 24, 1999.
Lower Columbia River Coho (Oncorhynchus kisutch) is currently a candidate for listing but has been proposed as threatened on June 14, 2004.

The following ESA listed natural salmonid populations occur in the subbasin where the program fish are released:

ESA listed stock	Viability	Habitat
Fall Chinook	H	M
Spring Chinook	L	M
Summer Steelhead (Local)	M	M
Winter Steelhead (Local)	M	M
Coho- Hatchery and Natural (Proposed)	Na	Na
H, M and L refer to high, medium and low ratings, low implying critical and high healthy.		

2.2.2 Status of ESA-listed salmonid population(s) affected by the program.

Describe the status of the listed natural population (s) relative to "critical" and "viable" population thresholds. Critical and Viable population thresholds have not been established for these ESUs and the populations within them. NMFS has formed a Lower Columbia River/Willamette River Technical Review Team (TRT) to review population status within the ESU and develop critical and viable population thresholds.

Identify the ESA-listed population(s) that will be directly affected by the program.
Lower Columbia River Steelhead *(Oncorhynchus mykis*s), were listed as threatened under the ESA on March 19, 1998. The program will directly affect the Lower Columbia River Steelhead ESU because the program involves steelhead incubation, rearing, and acclimation throughout the basin.

Lower Columbia River Steelhead *(Oncorhynchus mykis*s), were listed as threatened under the ESA on March 19, 1998. In Washington, the LCR steelhead ESU includes winter and summer steelhead in tributaries to the Columbia River between the Cowlitz River and Wind River. Winter steelhead stock status is rated healthy in 2002 because this stock has maintained relatively stable escapement estimates within the normal range of variation (SaSI 2002). An escapement goal of 1,000 fish has been established for this native stock with wild production. Kalama summer steelhead are rated depressed based on a short-term severe decline in escapement from 1998 through 2001. The escapement goal for this stock is 1,000 adult spawners. Escapements in 1998 through 2001 have been only 14% to 33% of the goal. This is a native stock with wild production. Summer and winter steelhead have been observed spawning in the same area therefore runs are not always reproductively separate. An estimated 40% of returning naturally produced adults had at least one hatchery parent; however, wild stock has retained genetic traits of considerable adaptive value relative to the transplanted hatchery stock (Hulett and Leider 1989). Spawning occurs above Lower Kalama Falls in the mainstem and NF Kalama River and throughout many tributaries, including Gobar, Elk, Fossil, and Wild Horse Creeks with falls at RM 36.8 blocking upstream migration. WDW estimated potential summer and winter steelhead smolt production was 34,850; naturally-produced steelhead smolts migrating annually from 1978-1984 ranged from 11,175 to 46,659. Wild summer steelhead sport harvest in the Kalama River from 1977-1999 ranged from 5 to 2,978; since 1986 regulations limit harvest to hatchery fish. Summer hatchery steelhead are not produced in the Kalama but are transfers from Skamania and acclimated at Kalama No. 2 and released directly into the Kalama River.

Identify the ESA-listed population(s) that may be <u>incidentally</u> affected by the program.
Lower Columbia River Steelhead *(Oncorhynchus mykis*s)
Between 1989-2000 annual proportions of listed natural-origin fish on natural spawning grounds ranged from 0.45 to 1.00 and averaged 0.68 for that 12 year period (see Table 1 below). Since 1998, all direct hatchery-origin winter-run adults (the target stock of this HGMP) have been removed from the Kalama River at the trap at RM 10 and recycled back into the lower river fishery. The current management plan is to continue this program so that the primary steelhead spawning and rearing habitat above the trap site is accessible to the indigenous wild winter-run stock only. The only exception to this is the likely future passage of a small number of returning hatchery adults from the winter-run wild broodstock program (i.e., just enough to replace the expected production lost from the removal of wild broodstock fish the previous generation).

Table 1. Abundance of hatchery and wild summer run steelhead in the Kalama River basin by Return Year. The wild stock is the indigenous Kalama winter-run stock and the hatchery stock is the Beaver Creek or Elochoman River Hatchery stock that has historically been the primary source of hatchery winter-run smolts stocked in the Kalama River. Note that 1980 and 1981 are the years affected by the eruption of Mt. St. Helens and many of the apparent spawners in those years originated from out of the Kalama River basin. Wild return for BY 1998 and 1999 include spawners used as broodstock. Source is the WDFW Historical Data Base.

Return	Sport Harvest			Escapement			Total Run size		
Year	Hatchery	Wild	H&W Total	Hatchery	Wild	H&W Total	Hatchery	Wild	H&W Total
1977/78	4,304	633	4,937	3,539	1,015	4,554	7,843	1,648	9,491
1978	1,788	1,079	2,867	2,120	484	2,604	3,908	1,563	5,471
1979	1,623	832	2,455	1,929	718	2,647	3,552	1,550	5,102
1980	7,963	844	8,807	8,598	2,926	11,524	16,561	3,770	20,331
1981	4,077	2,978	7,055	12,301	1,385	13,686	16,378	4,363	20,741
1982	7,912	1,075	8,987	4,405	869	5,274	12,317	1,944	14,261
1983	919	1,621	2,540	908	247	1,155	1,827	1,868	3,695
1984	2,129	738	2,867	1,106	461	1,567	3,235	1,199	4,434
1985	3,517	854	4,371	2,424	473	2,897	5,941	1,327	7,268
1986	7,526	148	7,674	4,687	445	5,132	12,213	593	12,806
1987	4,103	217	4,320	2,199	848	3,047	6,302	1,065	7,367
1988	4,603	90	4,693	2,692	492	3,184	7,295	582	7,877
1989	3,398	74	3,472	924	731	1,655	4,322	805	5,127
1990	2,510	16	2,526	1,034	704	1,738	3,544	720	4,264
1991	2,284	5	2,289	1,588	1,075	2,663	3,872	1,080	4,952
1992	4,040	204	4,244	4,905	2,283	7,188	8,945	2,487	11,432
1993	2,559	72	2,631	2,797	1,041	3,838	5,356	1,113	6,469
1994	1,488	9	1,497	1,741	1,302	3,043	3,229	1,311	4,540
1995	521	4	525	1,150	614	1,764	1,671	618	2,289
1996	1,012	38	1,050	2,395	598	2,993	3,407	636	4,043
1997	946	2	948	555	205	760	2,210	207	2,417
1998	363	26	389	187	220	407	1,285	294	1,579
1999	1,147	71	1,218	30	140	170	2,409	250	2,659
2000	2,320	38	2,358	52	286	338	3,254	373	3,627
2001	1,377	41	1,418	228	454	682	2,807	553	3,360
2002	2,657	58	2,715	852	805	1,657	10,470	956	11,426
2003				1,138	632	1,770			

Identify the ESA-listed population(s) that may be incidentally affected by the program

Lower Columbia River fall chinook salmon *(Oncorhynchus tshawytscha)* within the Evolutionary Significant Unit (ESU) are federally listed as "threatened" under the Endangered Species Act effective May 24, 1999.

Status: WDFW has submitted natural and hatchery draft management guidelines for Kalama fall chinook that will be used in the interim until the TRT recommendations are developed (Fall 2003). In Washington, the LCR chinook ESU includes all naturally spawned chinook populations from the mouth of the Columbia River to the Cascade Crest. Native fall chinook have been reported in the Kalama, but a distinct stock no longer exists. The Kalama River fall chinook natural spawners are a mixed stock of composite production with a significant portion of the natural spawners hatchery produced fish. Kalama fall chinook are rated healthy because escapements have usually exceeded the escapement goal of 2,000 adults (SaSI 2002). Natural spawning abundance has exceeded 20,000 spawners, with spawning escapements from 1986-2001 ranging from 1,420 to 24,297 (average 6.287) but escapement levels have normally ranged from 2,000 to 4,000 since 1990. Although final escapement objectives have not been established by the NMFS through a recovery plan, WDFW has established draft interim minimum escapement objectives. The minimum fall chinook MSY escapement goal is 400 to 450 adult spawners passed above the weir (based on habitat between the weir and Kalama Falls Hatchery). Since some fish swim through the weir, this would lead to an escapement of 444 to 500 spawners in most years. In addition, there is a significant amount of spawning that occurs below the Modrow weir.

Lower Columbia River spring chinook salmon (*Oncorhynchus tshawytscha*) within the Evolutionary Significant Unit (ESU) are federally listed as "threatened" under the Endangered Species Act effective May 24, 1999. Critical and Viable population thresholds have not been established for these ESUs and the populations within them. NMFS has formed a Lower Columbia River/Willamette River Technical Review Team (TRT) to review population status within the ESU and develop critical and viable population thresholds. Reports of considerable historic numbers of spring chinook in the Kalama have not been verified and by the 1950s, only remnant (<100) spring chinook runs existed on the Kalama. Kalama spring chinook are a mixed stock with composite production and one of four spring chinook populations in the Columbia River Evolutionarily Significant Unit. Currently, natural spawning is concentrated on the mainstem Kalama between the Kalama Falls (RM 10.5) and Fallert Creek (Lower Kalama) Hatcheries (RM 4.8). Spring chinook enter the Kalama River from March through July with wild spring chinook passed above Lower Kalama Falls with spawners having been observed up to upper Kalama Falls (RM 36.8). Kalama River spawning escapements from 1980-2001 ranged from 0 to 2,892 (average 444). Hatchery strays account for most spring chinook spawning in the Kalama River although integration of wild and hatchery adults above Kalama Falls can be monitored.

Lower Columbia River Coho (*Oncorhynchus kisutch*) is proposed as threatened on June 14, 2004.
Status: NMFS concludes that the LCR coho ESU includes all naturally spawned populations of

remaining coho program is about 700,000 smolts released annually, split evenly between early stock (reared at Fallert Creek) and late stock (reared at Kalama Falls). (LCFRB Kalama Subbasin Report Volume II, Chapter 10).

2.2.3 Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed fish in the target area, and provide estimated annual levels of take.

Hatchery adult trapping, handling, holding, spawning, smolt release, smolt trapping, and other juvenile monitoring all involve a take potential to take listed wild winter-run and summer-run steelhead in the Kalama River. Details on the program are provided elsewhere in this document and in Sharpe et al. (2000).

Broodstock Collection:
Wild summer run steelhead are trapped throughout the broodstock capture period (May to August), Take is, up to a maximum of 10% of the wild escapement or 60 adult steelhead per year.
Adult Transfer: Once in the trap they are transferred via overhead brail into a 1,000 gallon tanker truck. Fish are then trucked a short distance (100 yards) and are released into a sorting pond measuring 10' X 80' X 4'.

Adult Holding/Spawning: Pre-spawn steelhead captured for use as broodstock will be held until ripe and spawned. Broodstock are generally live-spawned.

Incubation and rearing: Approximately 116,000 eggs per year will be taken for this program. Both intentional and unintentional take up to 350 smolts can occur.

Transfer of juveniles to acclimation sites: approximately 12,000 pre-smolts will be transferred from the Kalama Falls Hatchery to an acclimation site on Gobar Pond.

Acclimation: Pre-smolts will be held for approximately 9 weeks (February-April) at the acclimation site and then allowed to volitionally leave the pond upon smoltification.

Release: Indirect affects of hatchery releases on listed populations such as predation and competition are highly uncertain and although this HGMP discusses our current understanding, it is not feasible to quantify by number the associated take due to these activities.

Monitoring and Evaluation: For smolt research, up to 3200 smolts can be captured for research with up to 150 smolts taken. All others are released back to the river. In some years up to 5000 adults can be handled with 80 removed as broodstock. Another 40 (<1.0%) can be lost in handling.

Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

Smolt trapping operations will temporarily cease under conditions of extreme flow or other conditions known or suspected to pose high risk of injury to smolts. During times of peak smolt out-migration, traps will be monitored throughout the night and fish processed from the trap as necessary to avoid excess fish densities, debris loads, or other potentially injurious conditions. All hatchery procedures and research protocols are continuously evaluated and reviewed so that the work can be adaptively modified to minimize risk to the threatened fish and maximize potential for success of the program. Adult trapping is monitored daily and sorting can be increased to handle peak periods.

Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish.
In recent years essentially all wild steelhead attempting to enter the upper Kalama watershed are

captured and handled over the course of normal hatchery operations and the associated research programs in place. Since both winter and summer-run steelhead are listed in the Kalama, the total take is thus the sum of the run sizes within a calendar year for each of the races, less fish that evade capture in the trap. For 1998 and 1999, those totals were approximately 677 and 681 fish, respectively. Run size for 1999/2000 winter-run, however, was considerably larger (approximately 800 fish) and 2000 summer-run returns are also likely to be large (based on early returns, excellent smolt migration conditions in 1998, and apparently improved ocean conditions). Direct and immediate mortality on adult fish is low (< 1%). Delayed mortality rates are not known, but are likely low since mortality of wild summer-run (see separate HGMP) for broodstock and held for nearly 1 year is less than 10 %

Section 3: Relationship of Program to Other Management Objectives

3.1 Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the *NPPC Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.

Use of wild steelhead is integrated into the Lower Columbia Steelhead Conservation Initiative, especially the Monitoring and Evaluation elements of that initiative. The hatchery winter-run program in the Kalama is being used as what is effectively a control for the Kalama wild broodstock hatchery program, especially in the context of comparing smolt to adult returns of the traditional hatchery stock to the local wild broodstock. To that extent, the hatchery winter-run program is integrated into the Lower Columbia Steelhead Conservation Initiative, especially the Monitoring and Evaluation elements of that initiative. The production developed for this program will be integrated with *U.S. v Oregon* and the Columbia River Fish Management Plan (CRFMP) and with hatchery plans documented in WDFW's yearly Future Brood Document (FBD), and Lower Columbia Fisheries Management and Evaluation Plan (2002 FMEP) which has been agreed to by NOAA for listed steelhead, chum, and chinook in the ESU.

WDFW hatchery programs in the Columbia system adhere to a number of guidelines, policies and permit requirements in order to operate. These constraints are designed to limit adverse effects on cultured fish, wild fish and the environment that might result from hatchery practices. Following is a list of guidelines, policies and permit requirements that govern WDFW Columbia hatchery operations:

Genetic Manual and Guidelines for Pacific Salmon Hatcheries in Washington. These guidelines define practices that promote maintenance of genetic variability in propagated salmon (Hershberger and Iwamoto 1981). Also, *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Genetic Policy Chapter 5, IHOT 1995).

Spawning Guidelines for Washington Department of Fisheries Hatcheries. Assembled to complement the above genetics manual, these guidelines define spawning criteria to be use to maintain genetic variability within the hatchery populations (Seidel 1983). Also, *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Genetic Policy Chapter 7, IHOT 1995).

Stock Transfer Guidelines. This document provides guidance in determining allowable stocks for release for each hatchery. It is designed to foster development of locally-adapted broodstock and to minimize changes in stock characteristics brought on by transfer of non-local salmonids (WDF 1991).

WDFW Steelhead Rearing Guidelines. Details rearing guidelines and rearing parameters statewide (July 31, 2001).

Fish Health Policy in the Columbia Basin. Details hatchery practices and operations designed to stop the introduction and/or spread of any diseases within the Columbia Basin. Also, *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Genetic Policy Chapter 5, IHOT 1995).

National Pollutant Discharge Elimination System Permit Requirements This permit sets forth allowable discharge criteria for hatchery effluent and defines acceptable practices for hatchery operations to ensure that the quality of receiving waters and ecosystems associated with those waters are not impaired.

3.2 List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.

The program described in this HGMP is consistent with the following agreements and plans:

- The Columbia River Fish Management Plan
- U.S. vs. Oregon court decision
- Production Advisory Committee (PAC)
- Technical Advisory Committee (TAC)
- Integrated Hatchery Operations Team (IHOT) Operation Plan 1995 /Volume III.
- Pacific Northwest Fish Health Protection Committee (PNFHPC)
- In-River Agreements: State, Federal, and Tribal representatives
- Northwest Power Planning Council Sub Basin Plans
- Washington Department of Fish and Wildlife Wild Salmonid Policy

3.3 Relationship to harvest objectives.

Fisheries benefiting from the program will include sport fisheries in the Kalama Basin and the lower Columbia main stem. A formal harvest management plan is in development. Hatchery winter-run fish from the Beaver Creek stock reared at the Beaver Creek facility have been planted in the Kalama since the late 1950's. Table 4 provides some harvest information. The current hatchery program uses the same genetic stock and future returns and harvest rates are expected to be similar. By 2002, depending on the outcome of the ongoing research in the basin, the use of broodstock of non-local origin might be discontinued. Sport harvest in the Kalama Basin is listed below. It is unknown which fish are wild/hatchery-returning adults although a ratio of these compared with summer hatchery fish collected at Kalama Fall Hatchery can be determined.

Fisheries benefiting from the program will include sport fisheries in the Kalama Basin and the lower Columbia mainstem. Selective fisheries were initiated for steelhead in 1986 in the Lower Columbia River tributaries. This regulation requires the release of all wild steelhead. The estimated mortality for wild winter steelhead for these fisheries in lower Columbia River tributaries ranges from 4% to less than 7% per basin depending on the fishing regulations. Harvest rates have been as high as 70% for hatchery steelhead in the Cowlitz River. The current hatchery program uses the same genetic stock and future returns and harvest rates are expected to be similar. By 2002, depending on the outcome of the ongoing research in the basin, the use of broodstock of non-local origin might be discontinued.
Sport Harvest – See Table in HGMP Section 2.2.2.

3.4 Relationship to habitat protection and recovery strategies.

Subbasin Planning and the Lower Columbia Fish Recovery Board (LCFRB)
Kalama River HGMP processes are designed to deal with existing hatchery programs and potential reforms to those programs. A regional sub-basin planning process (Draft Kalama River Subbasin Summary May 17, 2002 is a broad-scale initiative that will provide building blocks of recovery plans use by the Lower Columbia Fish Recovery Board (LCFRB) for listed fish and may well use HGMP alternative ideas on how to utilize hatchery programs to achieve objectives and harvest goals. In order to assess, identify and implement restoration, protection and recovery strategies, Region 5 staff is involved in fish and wildlife planning and technical assistance in concert through the LCFRB including the role of fish release programs originating from Kalama Complex. Staff is assessing the risks posed by the hatchery program using the Benefit-Risk Assessment Procedure (BRAP) in tandem with the LCFRB recovery plan.

Habitat Treatment and Protection
WDFW is presently conducting or has conducted habitat inventories within the Kalama River

subbasin. Ecosystem Diagnosis and Treatment (EDT) compares habitat today to that of the basin in a historically unmodified state. It creates a model to predict fish population outcomes based on habitat modifications. WDFW is also conducting a Salmon Steelhead Habitat Inventory Assessment Program (SSHIAP), which documents barriers to fish passage. WDFW's habitat program issues hydraulic permits for construction or modifications to streams and wetlands. This provides habitat protection to riparian areas and actual watercourses within the watershed.

Limiting Factors Analysis
A WRIA 27 (Kalama, North Fork Lewis River, and East Fork Lewis River Salmon) habitat limiting factors report (LFA) has been completed by the Washington State Conservation Commission. Loss of channel diversity, increased sedimentation, reduced stream flows, habitat constriction due to effects of irrigation withdrawn, water temperature, and inundation and loss of spawning/rearing habitat through dam construction, and fragmentation of habitat all affect productivity of natural salmonid populations within the watershed. Reduced summer flows in recent years are likely the result of diminished glacial melt following the eruption of Mt. St. Helens.

3.5 Ecological interactions.

Below are discussions on both negative and positive impacts relative to the Kalama winter steelhead program and are taken from the Puget Sound listed and non-listed HGMP template (WDFW and NOAA 2003).

(1) Salmonid and non-salmonid fishes or species that could negatively impact the program: Kalama steelhead smolts can be preyed upon release thru the entire migration corridor from the Kalama river sub basin to the main stem Columbia River and estuary. Northern pike minnows and introduced spiny rays in the Columbia main stem sloughs can predate on steelhead smolts as well as avian predators, including gulls, mergansers, cormorants, belted kingfishers, great blue herons and night herons. Mammals that can take a heavy toll on migrating smolts and returning adults include: harbor seals, sea lions, river otters, and Orcas.

(2) Salmonid and non-salmonid fishes or species that could be negatively impacted by the program: Co-occurring natural salmon and steelhead populations in local tributary areas and the Columbia River main stem corridor areas could be negatively impacted by program fish. Of primary concern are the ESA listed endangered and threatened salmonids: Snake River fall-run Chinook salmon ESU (threatened); Snake River spring/summer-run Chinook salmon ESU (threatened); Lower Columbia River Chinook salmon ESU (threatened); Upper Columbia River spring-run Chinook salmon ESU (endangered); Columbia River chum salmon ESU (threatened); Snake River sockeye salmon ESU (endangered); Upper Columbia River steelhead ESU (endangered); Snake River Basin steelhead ESU (threatened); Lower Columbia River steelhead ESU (threatened); Middle Columbia River steelhead ESU (threatened); and the Columbia River distinct population segment of bull trout (threatened). Coastal cutthroat trout (*O. clarki*) are present in the Kalama watershed and seem likely to soon be listed under the ESA. Anadromous adult cutthroat are occasionally captured during adult trapping operations and downstream migrants are captured during smolt trapping operations. The steelhead hatchery program positively impacts the cutthroat in that very useful incidental data are collected on this species including spawner abundance indices and freshwater smolt production levels in addition to basic biological information on the species including size, sex, and run-timing. Kalama Research Team staff actively compile and distribute those data for the use of various entities engaged in planning of recovery efforts for the species. Listed fish can be impacted thru a complex web of short and long term processes and over multiple time periods which makes evaluation of this a net effect difficult. WDFW is unaware of studies directly evaluating adverse ecological effects to listed salmon. See also Section 2.2.3 Predation and Competition.

3) Salmonid and non-salmonid fishes or other species that could positively impact the program. Multiple programs including fall chinook and coho programs are released from the Kalama system and limited natural production of chinook, coho, chum and steelhead occurs in this system along with non-salmonid fishes (sculpins, lampreys and sucker etc.). Accept for yearling coho and steelhead, these species may serve as prey items during the emigration thru the basin. While not always desired from a production standpoint, these hatchery fish provide an additional food source to natural predators that might otherwise consume listed fish and may overwhelm established predators providing a beneficial, protective effect to co-occurring wild fish. Many watersheds in the Pacific Northwest appear to be nutrient-limited (Gregory et al. 1987; Kline et al. 1997) and salmonid carcasses can be an important source of marine derived nutrients (Levy 1997). Carcasses from returning adult salmonids have been found to elevate stream productivity through several pathways, including: 1) the releases of nutrients from decaying carcasses has been observed to stimulate primary productivity (Wipfli et al. 1998); 2) the decaying carcasses have been found to enrich the food base of aquatic invertebrates (Mathisen et al. 1988); and 3) juvenile salmonids have been observed to feed directly on the carcasses (Bilby et al. 1996). Addition of nutrients has been observed to increase the production of salmonids (Slaney and Ward 1993; Slaney et al. 2003; Ward et al. 2003). Assuming limited spawning, up to 1,000 adult carcasses could contribute approximately 10,000 pounds of marine derived nutrients to organisms in the Kalama River. *Saprolegniasis* occurrences in young hatchery fish have been observed in greater frequency on Mitchell Act stations and in some cases, circumstantial evidence suggests more outbreaks of gill and tail fungus are the result of nutrient enhancement efforts. Staff is continuing to monitor observations or occurrences of this possibility.

4) Salmonid and non-salmonid fishes or species that could be positively impacted by the program. Kalama steelhead smolts can be preyed upon release thru the entire migration corridor from the river sub basin to the main stem Columbia River and estuary. Northern pike minnows and introduced spiny rays in the Columbia main stem sloughs can predate on steelhead smolts as well as avian predators, including gulls, mergansers, cormorants, belted kingfishers, great blue herons and night herons. Mammals that benefit from migrating smolts and returning adults include: harbor seals, sea lions, river otters, and Orcas.

Section 4. Water Source

4.1 Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile and natural limitations to production attributable to the water source.

At Kalama Falls hatchery, in the fall/winter of 200/2001, a new intake pump station was constructed with FEMA monies after the flood 1996 damaged the facility. Five new pumps are capable of delivering approximately 16 cfs for rearing while two incubation pumps deliver 4 cfs for incubation. A settling pond for incubation water was recently completed. Additionally, there are two surface water gravity intakes on un-named creeks – one near the hatchery and one on the other side of the river and because of steep gradients have been determined by WDFW to be non-fish bearing. The hatchery water source and "natal" water source used by naturally spawning populations are the same with the exception of incubation and early rearing. The source for incubation and early rearing is obtained through a seasonal creek that is generally regarded as pathogen free. Water rights for hatchery operations total 26 cfs. All water quality parameters are monitored under the NPDES permit number WAG13-1039.

At Fallert Creek, water can be gravity fed from the creek intake providing up to 10,000 gpm depending on weather and stream conditions. Pumps need to used when dewatering becomes a concern late summer and early fall and the river intake is located adjacent to the hatchery with a four chambered pump system which can provide up to 5,000 gpm. Between the facilities, a total of 15,112 gpm is used (Montgomery Watson 1997).

4.2 Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

Potential Hazard	Risk Aversion Measure
Hatchery water withdrawal	Water rights total 26,031gpm from October to June (Montgomery Watson 1997) and are formalized thru trust water right #S2-24832 from the Department of Ecology. Monitoring and measurement of water usage is reported in monthly NPDES reports (see below). Gobar Pond is operated thru an MOA with Weyerhauser Corporation. Intake screens were inspected for compliance.
Intake/ Screening Compliance	At Fallert Creek hatchery, both intake and screen criteria are not in compliance as WDFW has determined that fish passage upstream is necessary. From the assessment, significant changes are needed, WDFW has been requesting funding for future scoping, design, and construction work of a new intake system (The Mitchell Act Intake and Screening Assessment 2002). The Kalama Falls intake was rebuilt in 2001 and is in compliance.
Hatchery effluent discharges. (Clean Water Act)*	This facility operates under the “Upland Fin-Fish Hatching and Rearing” National Pollution Discharge Elimination System (NPDES) general permit which conducts effluent monitoring and reporting and operates within the limitations established in its permit administered by the Washington Department of Ecology (DOE). WAG 13-1010. Monthly and annual reports on water quality sampling, use of chemicals at this facility, compliance records are available from DOE. Adherence with the NPDES permit will likely lead to no adverse effects on water quality from the program on listed fish. Discharges from the cleaning treatment system are monitored as follows: *Total Suspended Solids (TSS)*C1 to 2 times per month on composite effluent, maximum effluent and influent samples. *Settleable Solids (SS)*C1 to 2 times per week on effluent and influent samples. *In-hatchery Water Temperature* - daily maximum and minimum readings. Gobar Pond operates with in limits of production not requiring a NPDES permit. The production from this facility falls below the minimum production requirement for an NPDES permit, but the facility operates in compliance with state or federal regulations for discharge. Applies to Gobar Acclimation Satellite. Hatchery intake screens conform to NMFS screening guidelines to minimize the risk of entrainment of juvenile listed fish. Effluent discharge is in compliance with NPDES standards.

Section 5. Facilities

5.1 Broodstock collection facilities (or methods).

A trap operates 365 days a year at the Kalama Falls Hatchery. A brail-hoist system can transfer fish to holding and sorting ponds on-station with wild fish species monitored and released upstream of this point. Fish volitionally enter the trap via a step and pool ladder at Kalama Falls Hatchery. Once in the trap they are transferred via overhead brail into a 1,000-gallon tanker truck. Fish are then trucked a short distance (100 yards) and are released into a sorting pond measuring 10' X 80' X 4'. Fish to be kept for broodstock are moved to a holding pond 4800 cu.ft with 250-300 gpm.

5.2 Fish transportation equipment (description of pen, tank, truck, or container used).

A 1,000 gallon steel tank on a flat bed truck equipped with re-circulating pumps and supplemental oxygen system and adult release gate.

5.3 Broodstock holding and spawning facilities.

Ponds (No.)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
1	Standard Concrete Raceway	4800	80	20	3.0	250-500

Adults can be held for almost a year before spawning. The raceway is covered with temperatures ranging from 65 degrees F to 41 degrees F during holding stage.

5.4 Incubation facilities.

Adults are spawned at Kalama Falls Hatchery, and gametes (green eggs and sperm) are transferred to Fallert Creek Hatchery. Fertilization and water hardening occurs and eggs are placed in shallow trough incubation baskets. Flow is 5-6gpm with approximately 4,500 eggs/trough

5.5 Rearing facilities.

Shallow troughs are used for incubation, after hatching fry are moved to intermediate deeps. Sub-yearlings are moved back to Kalama Falls and transferred to Gobar Pond for release.

Ponds (No.)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Max. Flow Index	Max. Density Index
6	Shallow Troughs- Fallert Hatchery	6.3	15.2	1.0	0.412	6	nya	0.3
6	Fiberglass Interim Deep Troughs- Fallert Hatchery	144	16	3.0	3.0	50	nya	0.3
2	Standard Concrete Raceways- Kalama Falls Hatchery	4800	80	20	3.0	500	nya	0.3
1	Acclimation Pond- Gobar Satellite Facility	430000	nya	nya	nya	2600	nya	0.3

5.6 Acclimation/release facilities.

Acclimation with volitional release is the preferred release strategy for the program. At the present time the production is acclimated and released out of Gobar Pond which is an earthen pond with approximately 2 acres in surface area and a total pond volume of 430,000 cubic feet. The balance of the production is scatter planted throughout the upper Kalama River watershed during peak out-migration times. As necessary, fish deemed unlikely to migrate with the rest of their cohort may be released directly from Kalama Falls Hatchery, reared for an additional year, or held in Gobar Pond until Fall to avoid potentially negative interactions with natural production in the upper watershed.

5.7 Describe operational difficulties or disasters that led to significant fish mortality.

In 2003, juvenile mortality from an epizootic event of IHNV began in October and continued into the winter, with losses estimated at 9,833 (14% of the parr on hand in September) over the period from October through December. An additional loss (or shortage) of 4658 fish (8% of the presumed 58,971 fish on hand) was detected in late January when 54,313 fish were directly counted during the tagging process. While avian predators are known to take fish from the juvenile rearing vessels, we have no reliable estimates of the degree to which the shortage can be attributed to avian predation.

5.8 Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

- Multiple pumps and water sources are available as well as 24/7 staff ready to respond to emergencies.
- Fish Health protocols are followed (see section 7.7).
- Any mortality beyond normal past history would be communicated to Fish program staff for review and adaptive management.

Section 6. Broodstock Origin and Identity

6.1 Source.

Wild Kalama Summer steelhead is a native stock (SaSI 2002) with wild production.. Broodstock is collected and selected from natural/wild summer steelhead (fish with adipose fin) returning to the Kalama Falls Fishway Trap.

6.2.1 History.

Broodstock Source	Origin	Year(s) Used	
		Begin	End
Kalama River Summer Steelhead	N	1998	U

Studies to compare reproductive success of wild Kalama steelhead to that of hatchery reared fish spawned form wild summer-run brood stock began in 1998.

6.2.2 Annual size.

Up to 50 adults at a 1:1 ratio of males and females are needed. The intent is not to exceed 10% of the wild escapement. In 2003, 996 wild summer steelhead returned.

6.2.3 Past and proposed level of natural fish in the broodstock.

Since the program started, all broodstock have been wild steelhead.

6.2.4 Genetic or ecological differences.

Adults: Indigenous wild summer steelhead are genetically and behaviorally distinct from both the hatchery winter and summer steelhead traditionally stocked in the target basin (Kalama River) as judged by allozyme methods, run timing and spawn timing (Sharpe et al. 2000; Leider et al. 1984, 1986). Hatchery summer steelhead are Skamania stock derivatives.

Smolts: This program was initiated in 1998 using only natural-origin (unmarked) summer steelhead, so they should be similar to the natural-origin summer steelhead. However, program fish are released as one-year smolts, where natural-origin juveniles emigrate generally as two-year smolts.

6.2.5 Reasons for choosing.

Indigenous stock with Kalama Falls Hatchery and the lower falls providing logistical and research support and the segregation ability to conduct research for this program.

6.3 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

(1) Natural/wild summer steelhead not used as broodstock are trapped throughout the collection period (April); held for a short period (0-14 days) to gather biological data; and returned to the river upstream of the fishway trap.

(2) Program Wild Hatchery Summer Steelhead (hatchery-origin) are put upstream proportionally to replace the natural production potential of natural/wild winter steelhead used as broodstock.

Section 7. Broodstock Collection

7.1 Life-history stage to be collected (adults, eggs, or juveniles).

Wild winter steelhead adults.

7.2 Collection or sampling design

A portion of all wild fish handled at Kalama Falls hatchery are systematically (approximately every 10th fish) retained for broodstock.

7.3 Identity.

Broodstock are collected from wild fish only which can be identified by adipose fin.

7.4 Proposed number to be collected:

7.4.1 Program goal (assuming 1:1 sex ratio for adults):

70 broodstock at a 1:1 ration of females and males.

7.4.2 Broodstock collection levels for the last twelve years (e.g. 1990-2001), or for most recent years available.

Year	Adults			Eggs	Juveniles
	Females	Males	Jacks		
Planned	25	25	nya	nya	nya
1999	22	27	nya	nya	nya
2000	19	29	nya	nya	nya
2001	23	30	nya	nya	nya
2002	26	22			
2003	27	31			

7.5 Disposition of hatchery-origin fish collected in surplus of broodstock needs.

Listed summer-run steelhead not used as broodstock are trapped throughout the capture period and held for usually less than 24 hours. At that time, biological samples and data are collected (including scales, tissue, length, sex, racial origin, presence of marine mammal scars or lesions) and then returned upstream. If excess broodstock has actually been sequestered in the holding pond (i.e. run size is larger than anticipated) the extra spawners are passed upstream. Some wild-broodstock hatchery fish returning as adults are to be passed upstream as part of the natural production portion of the program. Live spawned fish can be released upstream. Adult returns in excess of the research or natural capacity needs are to be recycled back to the lower river fishery to provide additional harvest opportunity or to landlocked lakes.

7.6 Fish transportation and holding methods.

The wild summer fish beyond needs are held for a short period (0-7 days) at which time biological data is gathered and then returned to the river upstream of the fishway trap. Data collected (under anesthesia) includes fork length, sex, and DNA samples (~75 mm^2 from caudal fin) from all wild adults. In addition to those data, scale samples and a dorsal muscle plug (~50 mm^3, for allozyme genetic data) are collected from 10-25% of the adults.

7.7 Describe fish health maintenance and sanitation procedures applied.

Broodstock receives routine prophylactic formalin treatments at 1:6000 to minimize fungal infections and Paracide S treatments for *Icthyophthirius.* Integrated Hatchery Operations Team (IHOT), Pacific Northwest Fish Health Protection committee (PNFHPC), WDFW's Fish Health Manual November 1966, updated March 30, 1998 or tribal guidelines are followed. Fish health specialists make monthly visits and consult with staff. The adult holding area is separated from all other hatchery operations. All equipment and personnel use disinfection (chlorine) procedures upon entering or exiting the area. Disinfection procedures that prevent pathogen transmission between stocks of fish are implemented during spawning. Spawning implements are rinsed with an iodophor solution, and spawning area and implements are disinfected with iodophor solution at the days end of spawning.

7.8 Disposition of carcasses.

Adults are generally live-spawned but mortalities can be used as nutrient enhancement or taken to a landfill.

7.9 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

Fish are taken from throughout the spawning run (based on historical run timing records) to avoid selectively altering that character in the population. Adult sorting and handling in general is very hard on adult fish and routinely causes mortality that can be prevented with a modern sorting and handling system designed to cause the least harm possible to all fish handled. This is acknowledged in Section 1.16 Alternatives (Reform/Investment 2). Ovarian fluid and, occasionally, kidney / spleen samples are collected from female spawners to test for the presence of viral pathogens.

Section 8. Mating

8.1 Selection method.

Mates are selected from representative times within the migration window.

8.2 Males.

Males are used 1:1 in 2 X 2 factorial crosses.

8.3 Fertilization.

Females are generally lived spawned using air injection method into plastic containers. Males are strip spawned into plastic bags. Gametes are taken to Fallert Creek for fertilization and water hardening. Eggs from individual females are fertilized with milt from individual males. Eggs are water hardened in iodophor solution.

8.4 Cryopreserved gametes.

Not used.

8.5 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

- Fish are taken from throughout the spawning run (based on historical run timing records) to avoid selectively altering that character in the population.
- A maximum of 10% will be taken from the wild escapement.
- Factorial crosses are performed.
- Adult fish will be held in covered ponds and receive treatment for fungus through the holding period to maximize survival and condition.

Section 9. Incubation and Rearing.

9.1.1 Number of eggs taken and survival rates to eye-up and/or ponding.

Adults are spawned at Kalama Falls Hatchery, and gametes (green eggs and sperm) are transferred to Fallert Creek Hatchery.

Year	Egg Take	Green-Eyed Survival (%)	Eyed-Ponding Survival (%)	Egg Survival Perfor-mance Std.	Fry-fingerling Survival (%)	Rearing Survival Perfor-mance Std.	Fingerling-Smolt Survival (%)
1999	88564	92.0	Na	Na	Na	Na	92.0
2000	60405	71.0	Na	Na	Na	Na	92.0
2001	101165	77.0	Na	Na	Na	Na	69.0
2002	99481	85.0	Na	Na	Na	Na	Na
2003	93535	95.0	Na	Na	Na	Na	Na

9.1.2 Cause for, and disposition of surplus egg takes.

Extra eggs are taken as a measure against expected incubation mortality. Excess juveniles will be stocked in local lowland lakes.

9.1.3 Loading densities applied during incubation.

Fertilized eggs from each female (approx. 3000 – 4,500 eggs/female anticipated) are incubated in shallow baskets in troughs.

9.1.4 Incubation conditions.

Pathogen free water provided by the small stream running through the Fallert Creek Hatchery grounds. Eggs are incubated under cover with dead eggs picked periodically. After eyeing, they are shocked and picked with dead eggs removed again. Temperatures are monitored daily and range between 40 and 56 degrees F. Dissolved oxygen is generally at or near saturation at the influent with 7 ppm as the minimum acceptable effluent, although it generally stays within 80% to 90% of saturation. Visual monitoring of sediments in the incubators is conducted daily and are flushed if necessary.

9.1.5 Ponding.

Emergent fry volitionally move from incubation baskets into open environment of shallow trough. The degree of button up is usually a 1 to 2 mm slit in the ventral surface. Swim up and ponding are forced. Temperature units at ponding average 1,100. Average length is 33.4 mm with a co-efficient of variation averaging 5.85%.

9.1.6 Fish health maintenance and monitoring.

Current treatment is a 1,667 ppm drip of formalin for 15 minutes daily to control fungus on the eggs. Egg mortality is removed by hand picking. Fry mortality at ponding is generally less than 3%. Monitoring for disease is done on a continuous basis with monthly scheduled visits by the area Fish Health Specialist. Disease treatment varies with the pathogen encountered but generally is antibiotic in nature for bacterial infections and bath or drip treatments with chemotheraputants for external infections.

9.1.7 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

The water source for incubation is regarded as pathogen free and particulate matter is settled out prior to entering incubation units. Staff is available 24/7 to respond to problems.

9.2.1 Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1990-2001), or for years dependable data are available.

See section 9.9.1

9.2.2 Density and loading criteria (goals and actual levels).

After hatch, early swim up occurs at low densities. Fry are allowed to swim up before initial feed introduction. At approximately 1.5 grams the fry are transferred to intermediate rearing vessels (15’ X 3’ X 3’ troughs or equivalent). Loading is kept at 5/lb/gpm (0.44 kg/1pm) inflow.

9.2.3 Fish rearing conditions.

Fish are reared from ponded fry to approximately 80-100 fpp at Fallert Hatchery. Fish are transferred from Fallert Hatchery to Kalama Falls Hatchery. Fish are reared at the Kalama Falls Hatchery, and split into two groups after marking in early March.

IHOT standards are followed for: water quality, predator control measures (netting) to provide the necessary security for the cultured stock, loading and density. Environmental parameters: flow rates, water temperatures, dissolved oxygen and Total Settable Solids (TSS) are monitored on a routine basis thru the rearing period.

9.2.4 Indicate biweekly or monthly fish growth information (average program performance), including length, weight, and condition factor data collected during rearing, if available.

Rearing Period	Length (mm)	Weight (fpp)	Condition Factor	Growth Rate	Hepatosomatic Index	Body Moisture Content
April 1999	NA	1700	NA	nya	nya	nya
May 1999	NA	1371	NA	0.194	nya	nya
June 1999	NA	376	NA	0.726	nya	nya
July 1999	NA	122	NA	0.676	nya	nya
August 1999	NA	55	NA	0.549	nya	nya
September 1999	116.7	23.4	NA	0.575	nya	nya
October 1999	124.9	18.9	NA	0.192	nya	nya
November 1999	137.2	15.4	NA	0.185	nya	nya
December 1999	149.2	12.4	NA	0.195	nya	nya
January 2000	155.0	10.9	NA	0.121	nya	nya
February 2000	157.1	10.1	NA	0.073	nya	nya
March 2000	174.8	7.5	NA	0.257	nya	nya
April 2000	185.3	6.5	NA	0.133	nya	nya
May 2000	199.5	5.6	NA	0.139	nya	nya

9.2.5 Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.

See HGMP Section 9.1.4 above.

9.2.6 Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

Rearing Period	Food Type	Application Schedule (#feedings/day)	Feeding Rate Range (%B.W./day)	Lbs. Fed Per gpm of Inflow	Food Conversion During Period
1700-525 fpp	Moore Clark Nutra 0	nya	2.5-3.0	nya	nya
525-275 fpp	Moore Clark Nutra 1	nya	2.5-3.0	nya	nya
275-125 fpp	Moore Clark Nutra 2	nya	2.0-2.5	nya	nya
125-80	Moore Clark Nutra Fry 1.2	nya	2.0-2.5	nya	nya
80-40 fpp	Moore Clark Nutra Fry 1.5	nya	2.0-2.5	nya	nya
40-12	Moore Clark Nutra Fry 2.0	nya	2.0-2.5	nya	nya
12-7	Trout AB	nya	2.0-2.5	nya	nya
7-5	Trout AB	nya	2.0-2.5	nya	nya

NOTE: Feed rate is applied in accordance with program goals not to exceed 0.1-0.15 pounds feed per gallon inflow depending on fish size. Average season conversion rates generally are no greater than 1.3:1.0

9.2.7 Fish health monitoring, disease treatment, and sanitation procedures.

Fish Health Monitoring	Policy guidance includes: *Fish Health Policy in the Columbia Basin*. Details hatchery practices and operations designed to stop the introduction and/or spread of any diseases within the Columbia Basin. Also, *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Genetic Policy Chapter 5, IHOT 1995). A fish health specialist inspects fish programs at Kalama Complex monthly and checks both healthy and if present symptomatic fish. Based on pathological or visual signs by the crew, age of fish and the history of the facility, the pathologist determines the appropriate tests. External signs such as lesions, discolorations, and fungal growths will lead to internal examinations of skin, gills and organs. Kidney and spleen are checked for bacterial kidney disease (BKD). Blood is checked for signs of anemia or other pathogens. Additional tests for virus or parasites are done if warranted.
Disease Treatment	As needed, appropriate therapeutic treatment will be prescribed to control and prevent further outbreaks. At Kalama No. 2, fish were treated with formalin for *costia* and with florfenicol for *Frunculosis*. At Kalama Falls fingerlings were treated with Paracide S for *Ichthyophthirius,* adults with Paracide S for fungus control, and Oxytetracycline for *Frunculosis*. Mortality is collected and disposed of at a landfill. Fish health and or treatment reports are kept on file.
Sanitation	All eggs brought to the facility are surface-disinfected with iodophor (as per disease policy). All equipment (nets, tanks, boots, etc.) is disinfected with iodophor between different fish/egg lots. Different fish/egg lots are physically isolated from each other by separate ponds or incubation units. The intent of these activities is to prevent the horizontal spread of pathogens by splashing water. Tank trucks are disinfected between the hauling of adult and juvenile fish. Footbaths containing disinfectant are strategically located on the hatchery grounds to prevent spread of pathogens.

9.2.8 Smolt development indices (e.g. gill ATPase activity), if applicable.

The migratory state of the release population is noticeable by fish behavior. Aggressive screen and intake crowding, swarming against sloped pond sides, leaner condition factors, a more silvery physical appearance and loose scales during feeding events are signs of smolt development that can be observed by staff. Multiple smolt events can also be triggered by environmental cues including daylight increase, a spike in the water temperature and spring freshets. ATPase activity is not routinely measured.

9.2.9 Indicate the use of "natural" rearing methods as applied in the program.

Not applicable but smolts from wild progeny both summer and winter are co-mingled with hatchery winter steelhead in Gobar Pond for final rearing and acclimation. Gobar Pond provides some natural food items as it is a gravel lined acclimation pond in the upper Kalama system.

9.2.10 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

- Steelhead research at Kalama Falls has been ongoing for years and has resulted in scientific protocols and techniques to handle listed fish populations.
- Facilities provide secure research and operational environment through the use of alarm systems, emergency plans and 24/7 staff.
- Hatchery and research programs operate under approved genetic, spawning, stock transfer, fish health and NPDES discharge requirements.

- Wild smolts and hatchery program smolts are marked to allow identification.
- Wild smolts are acclimated and released in areas and timing that mimics wild steelhead in the Kalama system.
- On-going research and adaptive management will provide monitoring needed for the future.
- In addition to the measures describing care and handling of the listed fish provided in sections 2, 8, 9, 11, and 12 of the HGMP actual take will be determined on an annual basis and compared to the levels detailed in the appended take table. Causes for any take in excess of those provided in the take table will be identified and corrective action will be taken to remedy the problem.

Section 10. Release

10.1 Proposed fish release levels.

Up to 60,000 smolts is the program production. Depending on rearing losses, the actual production has been less in most years except for 2000.

10.2 Specific location(s) of proposed release(s).

Fish are reared at the Kalama Falls Hatchery, and split into two groups after marking in early March. 20% of the program production is transferred in early March to the Gobar Acclimation Facility (RKm 4.8) to the Kalama River. Fish are reared/acclimated, and volitionally released from the Gobar acclimation pond during mid-April to early May. This window is within the time-frame of the natural migratory pattern of the stock. The remaining 80% of the production at Kalama Falls Hatchery is direct released at various sites in the Kalama Subbasin in groups of 2,000 – 3,000 smolts per plant at Kalama River miles 16.7, 20.8, 24.6, 31.1, 33.1, 34.3 and 36.5. (RKm 27.4-59.8).

10.3 Actual numbers and sizes of fish released by age class through the program.

	Fry Release			Fingerling Release			Yearling Release		
Release Year	No.	Date (MM/DD)	Avg size (fpp)	No.	Date (MM/DD)	Avg Size (fpp)	No.	Date (MM/DD)	Avg Size (fpp)
2000	nya	nya	nya	nya	nya	nya	70227	Early May	6.0
2001	nya	nya	nya	nya	nya	nya	39274	Early May	6.0
2002	nya	nya	nya	nya	nya	nya	37733	Early May	6.0
2003	nya	nya	nya	nya	nya	nya	36104	May 1st-7	7.65

10.4 Actual dates of release and description of release protocols.

A portion of fish from Gobar Pond are released volitionally then forced and occurs through April and May. Remaining fish are planted at various release site such as bridge crossings between RM 17 and RM 37 to coincide with peak timing of natural migration from the system. The combination of trucked smolts and acclimation/volitional release is the preferred release strategy, but in the future, different release strategies may be adopted as necessary including: isolation of fish not likely to smolt at Kalama Falls Hatchery for direct release into the lower watershed (below the majority of wild spawning waters), and retention of the fish at Kalama Falls Hatchery for additional rearing and release as two year smolts, and retention of the non-migrant fish in Gobar pond for additional rearing until fall.

10.5 Fish transportation procedures, if applicable.

Fish transported for off-station release at the acclimation site or up river plants are in transit for approximately 1.0 hours. Loading densities are kept between 0.5 and 1.0 pounds per gallon. Salt is added to the tanker at a rate of 0.5% of the volume by weight. Temperature is monitored in the tank and tempering is performed at the release site if the difference between the tank and the release water is greater than 7 degrees F. Supplemental oxygen is administered at 2.5 liters per minute.

10.6 Acclimation procedures (*methods applied and length of time*).

Gobar Satellite Facility Group- 20% of the program production is transferred in early March to the Gobar Acclimation Facility. Fish are reared/acclimated, and volitionally released from the Gobar acclimation pond during mid-April to early May. Fish of the Wild Summer Steelhead, Wild Winter Steelhead, and Hatchery Winter Steelhead Programs are commingled/acclimated in the Gobar acclimation pond.

10.7 Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

Wild summer steelhead are adipose fin-clipped marked and blank cheek or snout tags (depending on brood) are inserted

Table 2. Combinations of blank wire placement, cold brands, and fin clips applied to juvenile summer-run steelhead from the Kalama wild broodstock production and evaluation program, for the 1999 through 2003 brood years.

Brood Year	Blank Wire Placement	Cold Brand ("letter" and location)	Fin Clips
1999	Snout	"S" anterior dorsal position, left side	Adipose
2000	Snout	No brand	Adipose
2001	Right Cheek	No brand	Adipose
2002	Snout	No brand	Adipose
2003	Right Cheek	No brand	Adipose

10.8 Disposition plans for fish identified at the time of release as surplus to programmed or approved levels

Current program has not significantly exceeded program levels due to losses during the rearing period. If in the event losses are reduced and levels exceed program goals, then fish would be released based on consultation with NOAA.

10.9 Fish health certification procedures applied pre-release.

Prior to release, population health and condition is established by the Area Fish Health Specialist. This is commonly done 1-3 weeks pre-release and up to 6 weeks on systems with pathogen free water and little or no history of disease. Prior to this examine, whenever abnormal behavior or mortality is observed, staff also conducts the Area Fish Health Specialist. The fish specialist examines affected fish, and recommends the appropriate treatment. Reporting and control of selected fish pathogens are done in accordance with the Co-managers Fish Disease Control Policy and IHOT guidelines.

10.10 Emergency release procedures in response to flooding or water system failure.

Every effort will be made to avoid pre-programmed releases including transfer to alternate facilities. Emergency releases, if necessary and authorized, would be managed by removal of outlet screens and stoplogs of the rearing vessel.

10.11 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

- Fish will be released in a manner to promote out-migration that mimics wild steelhead. Spreading the release interval over a month or more results in a more gradual out-migration of fish. This is to avoid disruption of wild fish migration behavior due to the "quick pulse" flushing of very large numbers of hatchery fish at a given time (e.g. "pied piper" effect or other behavioral perturbations).

- Steelhead Rearing Guidelines target release sizes and condition factors that result in actively migrating smolts that vacate the system and limit freshwater interactions with listed species (WDFW - July 31, 2001).
- A release date that mimics natural out-migration is implemented (May 1st on) to allow listed Chinook to grow to a size (early May) that will help reduce predation opportunities, and be in advance of winter and summer steelhead fry emergence and after peak chum emergence.
- WDFW proposes to continue monitoring, research and reporting of hatchery smolt migration performance behavior, and intra and interspecific interactions with wild fish to assess, and adjust if necessary, hatchery production and release strategies to minimize effects on wild fish.
- WDFW fish health and operational concerns are communicated to Region 5 staff for risk management or needed treatment.

Section 11. Monitoring and Evaluation of Performance Indicators

11.1.1 Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

1. Smolt-to-adult survival and fishery contribution rates: Smolt to adult survival is to be assessed for both hatchery and wild steelhead in the Kalama basin. Multiple methods for estimating smolts out are in use: a subsample of smolts trucked to release sites are carefully weighed to establish average weight of fish being placed in each truckload and the total number of fish is established using the volumetric displacement method. Smolts volitionally leaving the acclimation pond are automatically counted using a commercially available array of counting tubes. Smolt traps fished in the upper watershed and at the Kalama Falls facility estimate migration rates (for wild and hatchery fish) out of the Kalama system. The number of adults back is estimated by counting fish handled at the adult trap at Kalama Falls Hatchery, adding in harvested fish estimated from harvest records, and by performing a comprehensive (mainstem and major tributaries) snorkel survey each year. In future years, after adult offspring of the wild broodstock begin to return, a creel survey will also be conducted.

11.1.2 Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

The existing monitoring and evaluation work at the Kalama facilities has been in place for in excess of 20 years, continuously funded by NMFS as provided under the Mitchell Act. That history is the limit of our certainty of continued funding.

11.2 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

Design and implementation of all research activities associated with monitoring and evaluation of Kalama facility operations follows peer review by internal (WDFW) staff as well as external interested parties including NMFS, USFWS, USGS-BRD, ODFW, and various academic entities.

Section 12. Research

12.1 Objective or purpose.

The objectives of this work are to: 1) design and implement a wild broodstock hatchery program, 2) assess the reproductive success of hatchery fish from wild broodstock relative to that of wild fish, 3) measure interbreeding between wild fish and hatchery fish from wild broodstock and its effect on productivity of the naturally spawning population, and 4) assess the efficacy of wild broodstock hatchery programs in achieving natural production and other fishery management objectives including containment of risks to wild stocks. A thorough treatment of goals and objectives of the program as well as justification for and benefits of the work in the Kalama Basin is provided in Sharpe et al. (2000).

In 2004, a hormonal implant (GnRHa; Ovaplant, Syndel Laboratories Ltd, Vancouver BC), was tested on returning female and male steelhead to reduce the duration of the spawning season that creates fish culture challenges to rear the program (Kalama Research Semi-Annual Report: October 1, 2002 – March 30, 2003.

12.2 Cooperating and funding agencies.

WDFW and NMFS (Mitchell Act funding)

12.3 Principle investigator or project supervisor and staff.

Patrick Hulett (PI-Fish Biologist 3), Cameron Sharpe (Fish Biologist 3), and Chris Wagemann (Fish Biologist 2).

12.4 Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.

Kalama River portion of listed Lower Columbia River Steelhead including both winter- and summer-run steelhead.

12.5 Techniques: include capture methods, drugs, samples collected, tags applied.

Adults are captured in the trap at the Kalama Falls Hatchery, loaded by brail into a fish transport truck and trucked approximately 200 meters to the sorting pond on station. The fish are periodically (2-5 times per week, depending on numbers of fish) crowded in the sorting pond, anaesthetized with CO_2, tagged with a Floy tag, and either sequestered as broodstock or returned to the river to continue their upstream migration. A tissue sample (fin clip) is removed from all adults for DNA analysis. In addition, a small muscle biopsy is performed on a representative sub-sample (100-200 fish per year) to provide tissue for allozyme analyses and a scale sample obtained for aging. For adult fish sequestered as broodstock, the fish are held at low densities in covered hatchery ponds with daily prophylactic formalin treatments. The fish are disturbed as little as possible until the fish are sorted by sex and checked for ripeness. Sorting and, eventually, spawning are conducted under anesthesia (MS222). Females are generally live-spawned using the air injection method and males are strip spawned. Surviving adults are returned to the river to allow for the potential for repeat spawning in subsequent years. Mortalities are examined to
ascertain cause of death.

To facilitate identification of hatchery-origin juveniles at all life history stages, all the fish receive blank wire tags in the snout or cheek, depending on brood. Juvenile fish are sampled from the hatchery facilities and from the river throughout rearing and during downstream migration as smolts. For samples taken during rearing, fish are netted from the rearing or acclimation ponds and anaesthetized with MS222. Length, weight, fin condition and degree of smolt development are recorded and the fish are returned to their rearing vessels. For samples taken from the river, juveniles (both wild and "hatchery") are captured primarily using two rotary screw traps at RM 37 and 20 and treated as described above. A representative sub-sample is wire tagged and injected with a fluorescent pigment and released above each trap site to allow estimation of trap efficiency. The remaining fish are released from the trap to continue their downstream migration. Instream juveniles are also sampled using electro-fishing (in compliance with NMFS Electrofishing Guidelines) and angling methods to estimate degree and patterns of residualism.

12.6 Dates or time periods in which research activity occurs.

The research project as detailed in Sharpe et al. (2000) will continue through 2011. The relatively intense monitoring of rearing, migration, and residualism will end with the out-migration of the 2001 brood in the spring and early summer of 2002. The balance of the research program will involve monitoring of smolt to adult returns and natural reproductive performance in subsequent years.

12.7 Care and maintenance of live fish or eggs, holding duration, transport methods.

See section 12.5.

12.8 Expected type and effects of take and potential for injury or mortality.

The Take Tables of Question 15.3 provide types and levels of take in this project. Virtually all adult steelhead attempting to enter the upper watershed will be captured and handled. Those fish are thus necessarily subjected to stress and risk of injury or mortality. However, the procedures used have been in place for over 20 years and, because of that experience, the potential for injury or mortality is low. All adults are handled quickly and efficiently in vessels of adequate volume and flow. The collection of important biological information and samples is carried out under anesthesia with attention paid to allowing sufficient recovery time before returning fish to the river. Adult fish sequestered as broodstock are held at low densities in covered hatchery ponds with daily prophylactic formalin treatments.

As with the adult sampling, the smolt trapping and other juvenile sampling operations subject fish to risk. Again, well established protocols are in place to ensure that the levels of risk and potential for injury or mortality are low. Also, only a fraction of the run of the river juvenile fish are sampled and most are of hatchery origin.

12.9 Level of take of listed fish: number of range or fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached “take table” (Table 1).

See HGMP section 2.2.3

12.10 Alternative methods to achieve project objects.

None

12.11 List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

Coastal cutthroat trout (Oncorhynchus clarki). Ongoing smolt and adult trapping efforts regularly entrain cutthroat trout. Actual levels of mortality associated with those activities are unknown but are assumed to be negligible. Assuming, for example, maximum mortality of 5% and given that 358 cutthroat are captured in 2000 (WDFW unpublished data) while conducting steelhead research, 18 mortalities could have occurred in this year. Capture rate for future years of the project are expected to be similar to that of 2000.

12.12 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury or mortality to listed fish as a result of the proposed research activities.

In addition to the measures describing care and handling of the listed fish provided in sections 2, 8, 9, 11, and 12 of the HGMP actual take will be determined on an annual basis and compared to the levels detailed in the appended take table. Causes for any take in excess of those provided in the take table will be identified and corrective action will be taken to remedy the problem.

Section 13. Attachments and Citations

13.1 Attachments and Citations

1. Bilby, R.E., B.R. Fransen, and P.A. Bisson. 1996. Incorporation of nitrogen and carbon from spawning coho salmon into the trophic system of small streams: evidence from stable isotopes. Can. J. Fish. Aquat. Scit. 53: 164-173.
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15. Slaney, P.A., B.R. Ward, and J.C. Wightman. 2003. Experimental nutrient addition to the Keogh River and application to the Salmon River in coastal British Columbia. *In* J.G. Stockner,(editor), Nutrients in salmonid ecosystems: sustaining production and biodiversity, p. 111-126. American Fisheries Society, Symposium 34, Bethesda, Maryland.
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Section 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

14.1 Certification Language and Signature of Responsible Party

"I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by_____________________________ Date:_____________

Take Table 1. Estimated listed salmonid take levels by hatchery activity. Table combines take associated with both the wild winter-run and wild summer-run and, in addition, the hatchery winter-run portions of the Kalama program (i.e., take tables from three separate winter- and summer-run HGMPs are not additive).

Listed species affected: Steelhead (*Oncorhynchus mykiss*) ESU/Population: Lower Columbia Steelhead				
Location of hatchery activity: Kalama River, WA Dates of activity: January-June (00-02) Hatchery program operator: WDFW				
Type of Take	**Annual Take of Listed Fish By Life Stage (*Number of Fish*)**			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)				
Capture, handle, tag/mark/tissue sample, and release d)		3,000[1]	5,000[3]	
Removal (e.g. broodstock e)				
Intentional lethal take f)				
Unintentional lethal take g)		150 [2]	40[4]	
Other Take (specify) h)				

Footnotes:

[1] Maximum likely number of wild juveniles sampled annually by smolt trap, electrofishing, and angling and then released after insertion of a wire tag and/or injection with a flourescent dye mark while sampling for hatchery fish.

[2] Maximum likely annual incidental mortality (5%) on naturally produced juveniles sampled by smolt trap, electrofishing, and angling while sampling for hatchery fish.

[3] Includes handling during normal hatchery operations of all of the maximum likely number of naturally produced adult summer-run and winter-run adults attempting to enter the upper watershed while sampling for hatchery fish and collecting hatchery-origin broodstock.

[4] Assumes maximum likely mortality (1%) during handling of all wild summer-run and winter-run adults over course of normal hatchery operations.